

# Making Mathematics Work for Minorities: A Challenge for Our Profession; A Service to Our Nation

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During the 1980s and the 1990s, both the American Mathematical Society and the Mathematical Association of America expressed their deep concern about the underrepresentation of American minorities, specifically American Indian, African American, and Hispanics, in the mathematics profession and more generally in the STEM (Science, Technology, Engineering, and Mathematics) professions. These minority groups constitute about 30% of our population. To reach these groups, our educational establishment has implemented teaching reforms at all levels: elementary, middle school, high school, and collegiate. Yet recent manpower studies conducted by the Congressional Research Service and the National Science Foundation [1], [2], [3], [4] reveal that the underrepresentation is still there. In short, these reforms offer us little to brag about.

In my opinion, a major problem is that teaching methodology and content matter that in previous decades successfully prepared our majority population as future citizens and STEM professionals were considered by some members of our educational establishment as inappropriate for our minority population if we wanted to produce some type of parity.

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On various occasions, I have vigorously disagreed with some of my colleagues, minority and majority, about the efficacy of some so-called reforms.

At this point, I wish to cite several pieces of research that share my point of view about the effective educational preparation of students at the precollege level, particularly minority students and/or students from low-income families. In 1996 Bonnie Grossen, an editor for the *Journal of Effective School Practices*, wrote an overview entitled “The Story Behind Project Follow Through” [5] for a series of research articles on Project Follow Through. Beginning in 1967 and over the next ten years, twenty-two sponsors worked with over 180 sites in an effort to break the cycle of poverty by improving education. Project Follow Through sought to evaluate the efforts by both economically and academically impoverished schools to achieve a level of education comparable with mainstream America during that time. This study was conducted through 1995. The study found that minority students benefited from explicitly organized and intensive academics in a teacher-led classroom, as exemplified by the approach called Direct Instruction. In 2001 Clifford Adelman prepared a U.S. Department of Education report entitled *Answers in the Toolbox* [6]. One of his findings was that minority students who enrolled in very rigorous academic high school courses

completed college at a higher rate than their white counterparts.

In 1979, with a grant from the U.S. Department of Energy and the assistance of Dr. Parker Lamb of the University of Texas at Austin College of Engineering, I started the program called the San Antonio Pre-freshman Engineering Program (SAPREP or PREP) at the University of Texas at San Antonio. In 1976, when I arrived at UTSA, I had observed that only a small number of students in my mathematics classes were minority, quite surprising because San Antonio is a city nearly 70% minority, mostly Mexican American. PREP started out as an eight-week summer mathematics-based academic enrichment program with the goal of identifying hardworking and able high school students—initially, high school juniors and seniors—who indicated an interest in science and engineering. The program emphasized the development of abstract reasoning skills and problem-solving skills in a highly structured teacher-led classroom setting. In the first summer of this eventual three-summer program, the major mathematics component of the program was basic mathematical logic and its application to theorem proving. Although the program was open to all students in the San Antonio area, special effort was focused on the recruitment of minority students. My ultimate goal was to establish a summer experience for beginning college students modeled after the summer mathematics program of my teacher and mentor, Arnold Ross.

It did not turn out that way. I quickly realized that if I was going to have an impact on a large number of local students at an age to make a difference, I needed to reach down to younger students who might benefit from the program. Arnold himself advised me to continue serving the younger students rather than emulating his program for older students. By 1984 most of the program participants were minority (and female) middle school students.

Every summer the PREP office has conducted, and still does, an annual follow-up of former participants that has revealed that most college-age former participants are indeed attending college and graduating from college, with at least 40% majoring in STEM areas. Today, San Antonio PREP has been replicated in thirty-five Texas community and senior college campuses and serves nearly 3,500 students annually, most of whom are minority. Some TexPREP sites have added components beyond the third year, which include students' taking college-level STEM courses while still in high school. Since many minority participants come from low-income families, some PREP sites offer students free lunches through the U.S. Department of Agriculture Summer Food Service Program and provide free transportation. Other program expenses are paid by local, state, and national public and private entities: the State of Texas, private

industry, foundations, local school districts, and participating colleges. Since 1979 over 14,000 students, mostly Hispanic, have completed at least one summer in San Antonio PREP.

My challenge to our profession is that we encourage the mathematics departments of our community and senior colleges to reach out to the local communities that they serve and to begin organized, concentrated efforts, especially in the summertime, to identify young, able, and hard-working middle school students, particularly local minority students, and to involve them in structured programs such as PREP. We already have programs such as the high-quality AMS-supported Young Scholars programs, but they are few and serve primarily high school students. I am proposing that outreach begin earlier and that a pipeline from middle school to college and even graduate school be developed especially for students who will ultimately enter college and pursue STEM majors at both the undergraduate and graduate levels. I also envision this effort being accomplished through a consortium of colleges and universities with primarily local constituencies working together with those with national constituencies. In order to recruit for these programs able students from low-income families, from which many of our minority students come, it will be important to offer these students complete financial assistance, including stipends for high school students who would otherwise need to work during the summer to assist their families.

What a significant contribution our profession could make if we prepared our future STEM professional workforce to reflect the face of our nation. More information about PREP can be found at <http://www.prep-usa.org>.

## References

- [1] DEBORAH D. STINE and CHRISTINE M. MATTHEWS, *The U.S. Science and Technology Workforce*, Congressional Research Service RL 34539, page 10.
- [2] *Minority Share of S&E and non-S&E Bachelor's Degrees: 1990–1996*, National Science Foundation, Division of Science Resources Statistics.
- [3] *Minority Share of S&E and non-S&E Master's Degrees: 1990–2006*, National Science Foundation, Division of Science Resources Statistics.
- [4] *Minority Share of S&E and non-S&E Doctoral Degrees to U.S. Citizens: 1990–2006*, National Science Foundation, Division of Science Resource Statistics.
- [5] Bonnie Grossen, The story behind Project Follow Through, *Effective School Practices* 15, no. 1, 1995–1996.
- [6] Clifford Adelman, *Answers in the Toolbox*, United States Department of Education, Office of Educational Research and Improvement, Washington, pages 3–7, 2001.